DOCUMENT RESUME

ED 126 109 TM 005 364

AUTHOR Nevo, David
TITLE A Model for the Utilization of Formative Evaluation in the Process of Developing Instructional Materials.
PUB DATE [Apr 76]
NOTE 25p.; Paper presented at the Annual Meeting of the American Educational Research Association (60th, San Francisco, California, April 19-23, 1976)

EDRS PRICE MF-$0.83 HC-$1.67 Plus Postage.
DESCRIPTORS *Curriculum Development; Curriculum Planning; Decision Making; *Evaluation Methods; *Formative Evaluation; Guidelines; *Instructional Materials; *Models

ABSTRACT

An applied model is presented for the utilization of formative evaluation in developing instructional materials. The model is introduced through a presentation of its conceptual rationale. A description is given of its methodology and instrumentation, and a demonstration presented of its development and utilization within the framework of a project for the development of instructional materials for culturally disadvantaged students at the junior high school level. Practical recommendations are provided for evaluators involved in curriculum development. (Author)

****
* Documents acquired by ERIC include many informal unpublished *
* materials not available from other sources. ERIC makes every effort *
* to obtain the best copy available. Nevertheless, items of marginal *
* reproducibility are often encountered and this affects the quality *
* of the microfiche and hardcopy reproductions ERIC makes available *
* via the ERIC Document Reproduction Service (EDRS). EDRS is not *
* responsible for the quality of the original document. Reproductions *
* supplied by EDRS are the best that can be made from the original. *
****

ED126109

A MODEL FOR THE UTILIZATION OF FORMATIVE EVALUATION IN THE PROCESS OF DEVELOPING INSTRUCTIONAL MATERIALS

by

David Nevo

School of Education
Tel-Aviv University

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
NATIONAL INSTITUTE OF EDUCATION

THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL NATIONAL INSTITUTE OF EDUCATION POSITION OR POLICY

"PERMISSION TO REPRODUCE THIS COPYRIGHTED MATERIAL HAS BEEN GRANTED BY

DAVID NEVO

TO ERIC AND ORGANIZATIONS OPERATING UNDER AGREEMENTS WITH THE NATIONAL INSTITUTE OF EDUCATION. FURTHER REPRODUCTION OUTSIDE THE ERIC SYSTEM REQUIRES PERMISSION OF THE COPYRIGHT OWNER."

A paper presented at the annual convention of the American Educational REsearch Association, San Francisco, April 19-23, 1976.

TM005 364

INTRODUCTION

The purpose of this paper is to present an applied model for the utilization of evaluation in the process of developing instructional materials. The model will be introduced through a presentation of its conceptual rationale, a description of its methodology and instrumentation, and a demonstration of its development and utilization during a three-year period within the framework of a project of curriculum development at the Tel-Aviv University.[1]

The evaluation model presented in this paper is based on a definition of evaluation derived from some theoretical propositions suggested by Stufflebeam[2] and by Scriven.[3] The term "evaluation" will be used herein to refer to the process of delineating, obtaining, and providing information on the merit of goals, designs, implementation, and outcomes of (educational) activities, to serve formative and summative purposes. This definition is comprised of four major elements. The first element suggests that the process of evaluation should

---

[1]The author would like to acknowledge the contribution of his colleagues at the NETA Project during the period 1970-1972. Their positive as well as negative attitudes towards evaluation provided an important source of inspiration for the development of this evaluation model.

[2]Daniel L. Stufflebeam, et al., Educational Evaluation and Decision Making. Itasca, Ill.: Peacock, 1971.

[3]Michael Scriven, "The Methodology of Evaluation". In Robert E. Stake (Ed.), Curriculum Evaluation, AERA Monograph Series on Evaluation, No. 1 Chicago: Rand McNally, 1967.

not be limited to the technical activities of measurement and data gathering ("obtaining"), but should also include activities intended to identify evaluation needs ("delineating") and provide the obtained information to the relevant audiences of the evaluation. The second element of this definition implies that evaluation concerns information on the assessment of merit, in an attempt to determine the worth or value of educational endeavors. The third element in the definition suggests that judgment of merit should not be limited to outcomes of educational activities but should also address questions related to the merit of their goals, their designs and their implementation. The fourth element in the definition reflects Scriven's distinction between formative and summative evaluation suggesting that evaluation should help to improve an educational product during the process of its development, and/or demonstrate the merit of the final product when its development is completed. However, the focus of the suggested evaluation model is on the formative use of evaluation in curriculum development, intended to improve the developmental process. Additional evaluation efforts are required when the development of a product is completed to demonstrate its educational merit.

ASSUMPTIONS

Several assumptions underlie the evaluation model presented in this paper. These assumptions should be considered before attempting to apply the suggested model to any given effort of instructional development. Violating these assumptions would obviously limit the utility of the model for a specific purpose. The model is based on five major assumptions. They are:

(1) The development of instructional materials implies a long process of coordinated efforts. This process can be shortened by efficient planning and coordination among its components. However, "short cuts" intended to skip significant stages of the developing process may lower the quality of the product and in the final analysis do not shorten the developmental process. The educational system must realize that the development of educational means should be allowed to benefit from long-term investments, similar to those available in industry or defense. Compared with the developmental processes in industry, which take advantage of the extensive pool of scientific knowledge, the process of development in education can rely only on the limited knowledge of the behavioral sciences. Thus, they can be expected to take longer and be much more difficult than those in industry or similar areas.

(2) The development of instructional materials must be

a cooperative task of a group of persons with a wide range of expertise and not an individual or small group effort with limited expertise. An integrated team of specialists in the subject matter, learning theory, teaching methods, new media evaluation and writing techniques should be involved in the development of curriculum materials. Such a team should replace the traditional "text book writer" if signigicant instructional materials are to be developed.

(3) Formative evaluation should be an integral part of the developmental process. This assumption has two important implications. First, evaluation has to be conducted from the beginning of the developmental process rather than at the end of this process. Secondly, formative evaluation should serve the needs of the developmental team rather than assess its effectiveness for external audiences. Efforts should be made to reduce the threat of evaluation by demonstrating its constructive role in the developmental process, even when such an effort might result in the coaptation of the internal evaluator and in a decrease in credibility for external audiences.

(4) The evaluation team or the evaluation specialist should not be the only ones involved in evaluation activities within the developmental process, although they should bear the main responsibility for the conduct of evaluation. It is not feasible to assume that the evaluation team can serve all evaluation needs of the development team, nor is it desirable that evaluation be perceived as something that

"belongs" only to the evaluation specialists. This assumption implies that curriculum developers have to be trained in evaluation theory and techniques to gain basic skills and develop a positive attitude toward evaluation.

(5) Decision makers throughout all levels of the development organization or project should be committed to the utilization of evaluative information in their decision-making process. This does not imply that all the decisions are based only on rational considerations, nor does it imply that all recommendations resulting from the evaluation must be adopted. However, decision makers should strive to increase the rationality of their decisions and be ready to justify those that contradict the evaluative information. In such cases the confrontation of the decision maker with the evaluation information might result in a significant contribution to the developmental process, even though the evaluation recommendations are rejected. No decision maker is ready to admit that he will not use the evaluative information unless it supports his decisions that already have been made. Too often evaluation is conducted when there are no intentions to make use of the results.

AN OVERVIEW OF THE EVALUATION MODEL

The evaluation model is based on experience in curriculum development which suggested that six major stages are involved in the development of an instructional unit. These stages are:

1. The planning stage;

2. The first draft stage;

3. The pre-trial edition stage;

4. The experimental edition stage;

5. The semi-final edition stage; and

6. The final edition stage.

Each developmental stage is accompanied by evaluation activities as shown in Figure 1.

Developmental Stage	Evaluation Activity
1. Planning	Context evaluation
2. First draft	Evaluation by unit developers
3. Pre-trial edition	Inspection by experts
4. Experimental edition	Laboratory trials
5. Semi-final edition	Field trials
6. Final edition	Reporting

Figure 1: Developmental stages and evaluation activities in the process of developing an instructional unit.

The suggested developmental process has an increasing spiral structure, in which the transition from one stage to another is based on information provided by evaluation activities. Each stage includes development of curriculum materials, evaluation, and revision of materials for the next stage of development. The spiral nature of the model implies also that in certain cases it is necessary to repeat the same stage several times until the materials are ripe for the next stage of development. The "growing" nature of the spiral structure is demonstrated in Figure 2. The developmental

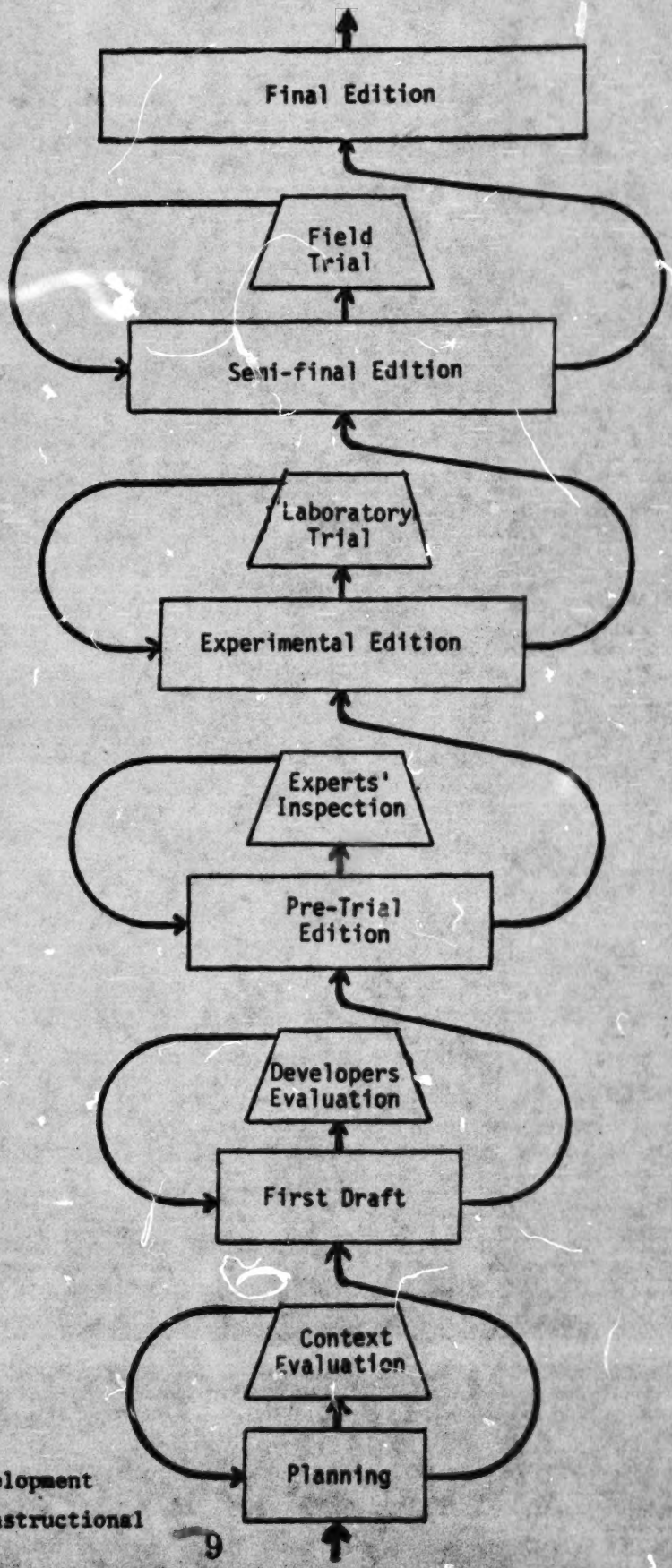

Figure 2. A Model for the Development and Evaluation of Instructional Units.

process starts with a planning stage in which the development team clarifies its task and structures the nature of the curriculum unit to be developed. A first draft of the unit is then developed and evaluated by the members of the development team to check its congruence with the rationale underlying its development. The first draft is revised into a pre-trial edition and submitted for inspection to a group of experts. Based on the feedback obtained from the various experts, an experimental edition of the unit is developed to be tried out with students and evaluated under laboratory conditions. A further revision of the unit is then introduced into a natural setting of the school and evaluated under conditions that hopefully approximate normal use of the unit. Based on the evaluation of this field trial a final revision of the unit is conducted. The unit may now complete its entire cycle of development and be ready for wide distribution and summative evaluation by potential consumers. The final edition of the unit is accompanied by an evaluation report which describes the entire developmental effort and presents the evaluative data gathered during the process of development.

The remainder of this paper is devoted to a description of the evaluation activities at the various stages of development, problems involved in implementing such activities, and examples of some solutions to such problems.

THE PLANNING STAGE

This stage starts when the development team has been assigned to the task of developing a curriculum unit on a defined or semi-defined topic. At the end of this state the topic of the unit has to be clearly defined, the subject matter to be covered by the unit has to be determined, instructional methods to be applied inthe unit have to be chosen, the general structure of the unit has to be defined, and a working plan for the team has to be developed. Decisions of the development team at this stage are facilitated by various kinds of information, such as information on the needs of students for whom the unit is being developed, general educational goals that must be served (e.g., goals prescribed by a mandatory syllabus), alternative teaching methods, and patterns of instructional materials. Such information can be obtained from the literature, official documents, educational consultants, or from direct observations in classrooms and interaction with teachers and students. Obviously, a systematic "needs assessment" study is desirable, although in most cases it is not feasible to conduct such a study at this stage and the team has to utilize existing knowledge (or assumptions) regarding the needs of students and teachers to be served by the unit.

Typical evaluation activities at this stage of development, as they were experienced in the NETA Project, included the following:

(1) Review of related literature. This is a joint effort of the development team and the evaluation staff. The development team focuses mainly on documents related to the subject matter of the unit while the evaluation staff reviews research and evaluation studies or related topics of interest, assesses their findings and provides summaries to the development team.

(2) Pilot observations in classrooms. The evaluation staff assists the development team in designing and conducting initial observations of classrooms occupied by students of the target population.

(3) Interviews of experts and practitioners. These interviews are mainly conducted by the development team; however, in certain cases, a more structured interview schedule may be developed and implemented by the evaluation staff.

Whenever feasible and desirable, two additional evaluation activities should be implemented at this stage. They are:

(4) A systematic "needs assessment"[4] study to delineate the needs of students and teachers to be served by the unit.

(5) An "input evaluation"[5] intended to develop and assess new approaches to problems confronted in the curriculum unit.

---

[4]See e.g., Ralph Hoepfner, et al., National Priorities for Elementary Education. CSE Monograph Series in Evaluation, Vol. 2, Center for the Study of Evaluation, University of California, Los Angeles, 1973.

[5]Stufflebeam, et al., Evaluation and Decision Making, pp. 222-229.

For this purpose the "advocate team" methodology can be utilized.[6]

THE FIRST DRAFT STAGE

This stage begins when the development team has clearly defined the topic of the unit and subject matter to be included, the instructional methods have been chosen, and a development plan has been approved. The team is ready to start writing a first draft of the various parts of the unit, including student objectives, reading materials, practice exercises, lab experiments, and the teacher manual. The team also starts developing supplementary materials for the unit such as models, charts, slides, and film loops.

At this stage two main questions should be answered:

(1) Are the materials being developed according to the plan proposed in the first stage?

(2) Is the unit being developed according to the "philosophy" of the project?

To answer these questions the development team can use a "checklist" comprised of specific questions regarding the various aspects of the unit. Within the NETA Project such a checklist has been developed by the evaluation team on the basis of some principles for the preparation and adaptation

---

[6]Diane L. Reinhard, "Methodology Development for Input Evaluation Using Advocate and Design Team." Ph.D. dissertation, The Ohio State University, 1972.

of instructional materials suggested by the project director.[7] The checklist was used by the development team throughout the process of developing the first draft of the unit in a attempt to revise the draft in such a way that most of the questions included in the checklist could be answered affirmatively. The answers provided by the development team are obviously subjective, therefore an additional attempt to answer the same questions in a more objective way is made in the next stage of the development. However, it seems to be important that a "self evaluation" be conducted at this stage as a basis for further evaluations and as an expression of the team's interest in the utilization of formative evaluation.

During the first draft stage the major evaluation activities are conducted by the development team rather than the evaluation team. The major efforts of the evaluation team at this stage are devoted to the development of an evaluation design for the project. The evaluators have to interface with the developers to delineate the evaluation needs of the next stages of the development process. The evaluation design and its instruments have to be developed in such a way that the evaluation needs of the project are adequately served. A common pitfall in the evaluation design is the use of measurement instruments based on their availability rather than on the evaluation needs of the project.

---

[7] Moshe Smilansky, "Assumptions for Preparation and Adaptation of Curricula and Media for the Culturally Disadvantaged." The NETA Project, Tel-Aviv University, 1968 (Mimeo.).

THE PRE-TRIAL EDITION STAGE

This stage starts whenever the development team has completed the revision of the first draft of the instructional unit according to the results of the "self evaluation" procedure described in the previous section. The unit is now perceived by the team as being congruent with its plans and principles underlying its development. It is now time to determine how the unit is perceived by others and to what extent it can be further improved prior to its trial in experimental classes. Many curriculum developers skip this stage of development as they are eager to introduce their products into school classes without any further delay. Such premature field trials should be discouraged. It is our experience that much can be learned about an instructional unit through its inspection by a panel of experts. The feedback provided by such experts can be much more valuable for the improvement of the unit than the information obtained from a premature field trial.

The following guidelines may be used in this regard: (a) The panel should include experts in various areas relevant to the development of the instructional unit such as subject matter, teaching methods or instructional media. (b) Although random selection of experts is not necessary, it is important to avoid a biased sample of experts whose opinions regarding the unit are known in advance. (c) The experts whould be asked to inspect the materials of the unit and answer a set of specific questions regarding their quality, asking the experts to re-

spond only to the question "What do you think about this unit?" is not advisable. A detailed questionnaire should be developed for this purpose; the checklist used for self evaluation in the previous stage can be used as a basis for developing the questionnaire. (d) The number of experts required for the inspection should be determined on the basis of the complexity of the instructional unit and the availability of time and resources for this purpose. From our experience, five to ten experts were sufficient.

It might also be appropriate at this stage to conduct some small-scale experiments to test specific aspects of the unit. These experiments should test components of the unit such as unique teaching methods, innovative media or special technical devices included in the unit.

The major responsibilities of the evaluation team during the pre-trial stage are: (a) assisting the development team in selecting a panel of experts; (b) analyzing experts' responses; (c) developing measuring instruments for the subsequent stages; and (d) conducting small-scale controlled experiments.

THE EXPERIMENTAL EDITION STAGE

Based on the feedback obtained from the evaluation at the previous stage of development, another version of the unit is now developed. This is the experimental edition of the unit to be tried out with students and evaluated under laboratory conditions. By "laboratory conditions" we refer to a controlled setting providing optimal conditions for implementation

in terms of the quality of physical resources, teaching personnel, motivation of teachers and students, and appropriate administrative support. Such conditions are usually not representative of the "real" conditions available in the educational system for which the unit is being developed. However, at this stage the question is not whether the unit can be implemented in an "average class" but whether it can be implemented at all.

The value of the experimental tryout of the unit should not be underestimated nor should it be overestimated. Its value is overestimated if we try to assess the effectiveness of the unit for our target population only on the basis of its performance under nonrepresentative conditions. It is underestimated if we fail to recognize its value in providing important feedback for the improvement of the unit in spite of the nonrepresentative conditions of the experimental trial.

The number of classes to be included in the experiment should be relatively small. It is determined mainly by the ability of the development team to assure optimal experimental conditions in the participating classes concerning teacher training, technical facilities, and intensive interaction with the experimental classes. Our experience showed that five to six classes are sufficient at this stage of development. The introduction of the experimental edition of the unit into a large sample of classes might limit the ability of the development team to monitor the experiment and utilize

the evaluative information that it can provide.

Teachers should be recruited on a voluntary basis to secure high quality instruction for the experimental tryout of the unit. Criteria for choosing teachers should be on the basis of competency, teaching experience, flexibility and commitment to the experimental effort. Teachers should be provided with extensive training in use of the unit in their classes, and should be required to implement it as prescribed by the development and evaluation teams--even if they disagree with some of the methods suggested in the teacher's manual. Their reservations should be considered in revising the experimental edition for the next stage of the development; however, at this stage the unit must be used precisely as intended by its designers. Instructional developers are sometimes reluctant to "force" teachers to follow their instructions to the letter, especially when the instructions are related to a unit which is intended to promote flexible and innovative teaching methods. A certain amount of rigidity is required to secure precise implementation of a new teaching method in order to be able to evaluate it adequately.

The major evaluation activity during the experimental stage should focus on the observation of the process of implementing the unit in the experimental classes. Several observation techniques can be used. One possibility is to develop a "scenario" of the unit which provides a detailed list of all the planned activities of the unit, their suggested sequence

and time estimate. The scenario is developed by the evaluator after studying the instructional unit and its supplementary materials. Interfacing with the developers he would validate the scenario and after several revisions he might end up with an observation form which could be used for classroom observations. Using the instrument in experimental classes will enable a comparison between planned and actual activities, and will provide valuable information in assessing the feasibility of implementing the unit as intended.

In many of the newly-developed instructional materials, efforts are made to "break" the traditional "talk and chalk" teaching method by introduction of various independent work/study activities of individuals and groups of students as well as other methods of active student involvement. In such cases it might be interesting to determine how much time is spent in the experimental class on active student participation as opposed to passive listening. Suppose that a class of 30 students is participating in a 45 minute lesson. This can be thought of as 1,350 student-minutes that can be utilized in one way or another. A simple observation instrument in the form of a matrix having a list of possible student activities[8] in rows and time (1 to 45) as columns will enable a trained observer to record the time devoted to each kind of activity. In our project we successfully used such an instrument for

[8] e.g., individual work, group activity, talking to class, listening to teacher, working individually with teacher, etc.

recording the number of students in each activity per minute. At the end of the observation the total number of student minutes is found for each activity and a percentage is calculated from the total number of student minutes in a given class (in our example, 1,350). This method ignores the content of the lesson but enables the distinction between classes that practice more student involvement and those using more "traditional" methods.

A third method of observation can be a nonstructured observation of unit developers in the experimental classes. Although this is not recommended as the only method to be used for a given unit, it is very important that any systematic observation conducted by the evaluators of the project be supplemented by such "non-systematic" and subjective observation conducted by those who developed the instructional materials and have to improve them. The insights that may be derived from this method are sometimes much more valuable than those from the other methods, and therefore should not be neglected.

Standardized observation schedules[9] can also be used to observe the activities in the experimental classes. These should be used only if they measure variables relevant to the evaluation of the unit. Too often, standardized instruments are used "just because they are available" and actually do not make any significant contribution to the development of the

[9]See for example: Simon, A. & Boyer, E.G. (Eds.), Mirrors for Behavior: An Anthology of Classroom Observation Instruments. Philadelphia: Research for Better Schools, 1968.

instructional unit.

The evaluation plan for the experimental stage should also include some measurement activities intended to assess student achievements. Standardized achievement tests can be used provided that they are related to the instructional objectives of the unit. However, in most cases special tests have to be developed to provide for measurement of the achievement of specific objectives that have been defined for the unit. Such tests have to be developed following the standard procedure for test development including item analysis which must be based on data obtained from students who have already studied the material covered in the test. Thus, the experimental stage is used not only for the trial of the instructional materials but also for trial of achievement tests which are to be used for the evaluation of those materials. The result of this is that one is actually trying to evaluate an incomplete instructional unit by means of an incomplete achievement test. Therefore, only limited conclusions can be drawn from such student achievement data. Further investigation in this area should be conducted in the next stage following the validation of the newly-developed tests.

THE SEMI-FINAL EDITION STAGE

On the basis of the evaluation of the experimental edition of the instructional unit under laboratory conditions a further revision of the unit is being developed in this stage. This semi-final edition will be introduced at this stage into a

natural setting of the school and evaluated under conditions that hopefully approximate normal use of the unit. Two major questions have to be answered by the evaluation at this stage. They are: (a) Is it feasible to implement the suggested unit in a regular school without providing special conditions such as those that were provided at the experiment stage? and (b) What impact does the unit have on the achievements of students in regular classes of the target population? To answer these questions a field trial must be conducted. The major differences between the field trial and the laboratory trial can be summarized as follows:

(1) Teachers should be selected on the basis of a random selection procedure rather than on a voluntary basis in order to ensure a more representative sample of the total teacher population for whom the instructional unit is being developed. Teachers who volunteer to participate in the trial of some innovative effort might be significantly different from the "average" teacher regarding known and unknown characteristics.

(2) No special training or guidance should be provided to teachers participating in the field trial except for the instructions provided in the teacher's manual of the unit or the kind of training prescribed by the unit for regular (not experimental) teachers.

(3) A considerably larger sample of classes should be used for the field trial to obtain a reasonable representation of the target population. However, one should bear in mind

that the representation of a sample is not determined only by its size but also by the procedure used for drawing the sample. Thus, a small random sample might be more representative than a large biased sample.

(4) The evaluation of student achievements should be done by means of the tests which were developed and validated at the previous stage.

(5) Although the major function of both the field and laboratory trials is formative rather than summative, the potential utilization of the field trial for summative purposes is obvious. However, since the evaluation at this stage is conducted by an internal evaluator whose credibility for external audiences might be limited, the involvement of some external independent evaluation agency in the process of the field trial is strongly recommended. Such an agency should serve as a secondary evaluator or meta-evaluator to increase the credibility of the evaluation in demonstrating the merit of the instructional materials for potential clients.

THE FINAL EDITION STAGE

The semi-final edition is now revised into a final edition on the basis of the results of the field trail. One should expect that if the instructional unit went through the whole process of development and evaluation, only minor changes would need to be introduced at this stage. However, should the results of the field trial suggest major revisions in the semi-final edition of the unit, an additional field

trial of the revised semi-final edition might be advisable prior to the establishment of the final edition.

When the final edition is completed, the instructional unit is ready for commercial production and dissemination to potential clients. The final edition of the unit should be accompanied by an extensive evaluation report which documents the entire process of development and provides evaluative data regarding the educational merit of the unit. Thus, the major task of the evaluator at this stage is the development of such an evaluation report. The evaluation report should concentrate on the results of the field trial, but it should also describe the earlier evaluation activities as a demonstration of the formative evaluation process. The evaluation report should point out the strengths as well as the weaknesses of the instructional materials and establish the limits of their usefulness by a complete description of the population on which it was used. If external evaluators participated in some way in the field trial, their assessments should also be included in the report. The style of the report should not be too technical, but at the same time it should include detailed data that can be reanalyzed by other evaluators. This might be accomplished by the inclusion of a narrative text with a few major statistical tables, as well as a more detailed presentation of statistical data in the form of an appendix. Some potential consumers of the instructional unit might be interested in an independent summative evaluation of the

unit prior to its adoption in their school systems; the internal formative evaluation should provide a solid basis for the conduct of such further evaluation.